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Technical note

Developing crime analysis in Mexico: case studies of cargo robbery on highways, illegal weapons trafficking, robbery of convenience stores and poppy cultivation

Authors:

Spencer Chainey (University College London, England) and Néstor Guerrero (Comisionado Nacional de Seguridad, Mexico)

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Abstract

Crime analysis is a fundamental part of modern policing. However, issues still exist in its practical adoption to support operational, investigative and strategic police activity in Latin American and Caribbean police agencies. These issues include technical skills weaknesses of analysts, the inability to effectively communicate analysis results in a meaningful and useful manner, barriers that restrict the flow of information and use of analysis within the organizational structure of the police, and a resistance to use analysis findings amongst frontline police officers. To help address this, the CNS in Mexico, with UCL and supported by the Inter-American Development Bank (IDB), embarked on a small-scale skills development program in crime analysis for eighteen CNS and Federal Police analysts. The skills development program was structured into three training blocks, delivered in Mexico City over a three month period, and included the analysts working in teams to develop an analysis project. This technical note describes elements of the training program and illustrates some of the learning that was received through the case studies relating to the analysis projects. We also describe how each analysis project has already informed police activity, and how more widely the skills development program has provided momentum towards improving the use of crime analysis in Mexico.

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Abbreviations

CNS - Comisionado Nacional de Seguridad

IDB – Inter-American Development Bank

INEGI - Instituto Nacional de Estadística y Geografía

NNPSA - National Network of Public Security Analysts

SARA – Scanning-Analysis-Response-Assessment

SNA – Social Network Analysis

UCL – University College London

1. Introduction

Police agencies are increasingly adopting intelligence-led, problem-oriented and evidence-base approaches to improve how they can reduce offending and prevent crime. A fundamental ingredient to each of these approaches is the ability to do good crime analysis: to facilitate an intelligence-led approach, data about criminal intelligence needs to be interpreted and used to inform police activity; within the problem-oriented approach, the problem solving method of Scanning Analysis Response Assessment (SARA) sequences within it the importance of analysis; and to be effective in the adoption of evidence-based principles requires the analysis of how a programme activity has impacted on the issues it was designed to address. Analysis is, therefore, central to helping to facilitate an effective police and citizen security approach by helping to better understand the issues that need to be tackled, helping to determine how they can be tackled, and evaluating if the activities that were then implemented had any effect.

The task of producing good analysis and ensuring analysis results are then used by police officers can, however, be a challenge. On occasion, the analysis may be rich in technical content, but presented in a format that police officers may find difficult to understand. On other occasions, the analysis may be detailed with interesting facts and figures but may be weak in explaining why the issue exists and provide little that police officers can use that help determine how best to tackle the problem. Whilst there is a time and place for only providing statistics about crime (e.g., for performance review purposes), crime analysis is often required to provide a richer understanding on why issues are present and identify ways in how these issues can be tackled. Strengthening skills in crime analysis must, therefore, not only involve improving technical analysis skills that examine recorded data, but must also ensure the task of doing analysis is approached in a manner that provides results that are easy to understand and help identify ways in which the issues can most effectively be tackled. Additionally, analysis units are often not located within the structure of an organisation that allows the unit to effectively liaise with police officers who can make most use of analysis findings and also contribute with information from their front line experiences. This positioning of analysis units within the organisational structure of a police agency can affect not only how operational departments make use of analysis, but also how analysis informs investigations and strategic decision-making. These challenges can be compounded further when the analysts are civilian officers who may find it communication with police officers difficult, and feel their ability to influence police action is inhibited by the hierarchical structure of the chain in command.

As part of a programme of work in improving police effectiveness in Mexico, the Inter-American Development Bank (IDB) have been supporting an initiative to help strengthen the competence and use of crime analysis. Mexico continues to experience citizen security concerns – it is one of seven countries in Latin America that continue to experience homicide rates greater than 10 per 100,000 inhabitants, with the first half of 2018 experiencing the highest number of homicides since records began in 1997. Strengthening the competence and use of crime analysis is seen as being a vital part to helping improve how the police in Mexico understand and respond to crime issues and tackle organised crime groups.

There are approximately 430,000 police officers in Mexico, operating across three jurisdictional levels: municipalities, states and the federal level. This compares to 222,000 police officers in Argentina and 178,000 police officers in Brazil (Bergman, 2018). Each level requires analytical support to help facilitate how, to who and where police resources should be targeted. In Mexico there are approximately 5,000 crime analysts working in local police departments across the country (INEGI) and 500 working at the federal level. The duties performed by analysts is defined by the size of the police department where they are based. In small police departments analysts are usually organised into teams by task functions, such as data gathering, statistical analysis, and qualitative analysis. In large police departments analysts are usually organised in teams relating to geographic areas or by the type of crime they are assigned to analyse. Furthermore, these analyst units are often divided further in relation to the particular service areas they support, meaning that analyst units are usually attached to three either the Chief of Police, the 911 call center, or the undersecretary of operations. There were not a general explanation of why to attach the analysis unit to any specific area, but could be related with the relevance of information analysis for the Chief of Police. This attachment to particular service functions helps to remove some of the barriers between analysis work and frontline operational and strategic police activity. To help address communication barriers between analysts and frontline police officers, analyst units are usually comprised of a mixture of civilian officers and sworn police officers. This has also helped to ensure there is a wide range of knowledge, skills and expertise in the analysis units in Mexico. What does remain, however, is the organisational resistance to make decisions based on analysis results and the evidence-base. To address this, the crime analyst community in Mexico has been keen to improve how analysis results inform and influence operational, investigative and strategic decision-making.

To help with this facilitation of analysis development, in November 2016 the Mexico National Conference of Secretaries of Public Security created the National Network of Public Security Analysts (NNPSA). Whilst analysts have been working in the police prior to November 2016, the objective of the NNPSA is to implement and formalise an effective process for crime analysis that helps to standardise and further develop the knowledge and skills of analysts working in police departments across Mexico. This programme of work is being led by the Comisionado Nacional de Seguridad (CNS).

The CNS includes within its functions the strategic planning and development of programmes that can help improve security, and the analysis that underpins this function. In order to help better inform the national programme of crime analysis, the CNS, supported by the IDB and with an international contribution from University College London in the United Kingdom embarked on a four month crime analysis skills development programme. The programme involved the attendance of sixteen analysts from the CNS and the Mexico Federal Police in a crime analysis skills development programme that was delivered over three training blocks. The inclusion of analysts from different parts of the federal government structure was useful as it was designed to help improve communication links between them. Each training block had a particular focus (crime analysis methods; technical analysis techniques; influencing decision-making with analysis), with each analyst working in one of five groups on issues that were of interest and relevant to each group. Analysis topics included the robbery of cargo trucks on highways, illegal arms trafficking, illegal poppy cultivation, money laundering, and convenience store robbery.

This technical note provides information about the crime analysis methods and techniques that were developed in Mexico as a result of the IDB supported crime analysis skills development programme. The technical note provides information about a hypothesis testing approach to crime analysis production that has begun to be adopted in Mexico (based on practice elsewhere), case studies from analysis projects developed from the skills analysis development programme, and details on how the results from the case studies and other aspects of the crime analysis skills development programme has resulted in action in Mexico. Section 5 provides information on the main technical analysis techniques that were taught during the programme, with several of these being illustrated in part in the case studies.

2. Improving the explanatory content of crime analysis using a hypothesis testing approach

In the last twenty years, the growth of intelligence-led, problem-oriented and evidence-based approaches in policing has placed a greater emphasis on the need to conduct analysis. The gathering of information and its interpretation is a key principle that underpins intelligence-led and problem-oriented policing, be it for supporting the daily tactical and operational targeting of police patrols, assisting an investigation, or for identifying persistent issues that require a strategic response. As these police approaches have been implemented and the production of analysis has become more formalised with the introduction of more routinised management processes (e.g., the adoption of police management frameworks such as National Intelligence Models and CompStat), with it has been the attempt to better integrate analysis and intelligence into the core of all police business and decision making. Often, these formal, systematic processes have resulted in the creation of a more standardised approach to analysis report production.

With this increasing demand for analysis and the subsequent standardisation of analysis reports has come the production of templates that aim to determine a consistent structure and content to these materials. Over time, the routine production of these analytical materials has led to many reports being constrained in their analytical creativity, most often providing only a general descriptive narrative of a crime or public safety problem (providing interesting facts and figures on who, what, where, when and how), rather than understanding why the problem exists or has recently emerged. In turn this can then limit and even undermine the role that analysis should play in influencing the decisions that then need to be made on what needs to be done about the crime issue. For example, if an analysis report offers little that a senior police officer can then use for determining how they go about tackling a particular crime issue, the role of analysis can then be questioned as offering little that is of practical use and is then avoided as a necessary step by these officers on subsequent occasions.

The hypothesis testing crime analysis approach is designed to help improve the explanatory content of analytical reports. It is based on the principle of identifying a number of plausible reasons for the crime problem (i.e., hypotheses) and using these to frame the direction and content of the analysis. Testing the hypotheses firmly focuses the analysis on determining 'why' the crime issue exists, drawing from techniques analysts would use for exploring who, what, where, when and how. For example, a reason/hypothesis to explain why burglary has increased in an area is "it's because we have had an increase in burglars, due to an

increase in the number of former prolific burglars recently being released from prison into our area". This hypotheses can then be tested by determining (using the available information) who has recently been released from prison, where they live, have they committed any burglaries since their release, and if so where have these offences been committed. Whilst the information on who has been involved in each burglary in the area will not always be complete, the information that is available is typically sufficient to be able to help conclude if the offending of these former prolific burglars is associated with the entire increase in burglary, part of the increase, or not at all. The process of deciding on the hypotheses to test is also designed to help improve the commissioning of analysis products. That is, it encourages a better dialog to occur between the person requesting the analysis and the analyst.

The production of analysis using the hypothesis testing approach involves four stages:

- Stage 1 – The overview: this involves clearly defining the crime problem. It should determine the magnitude and scale of the problem, trends, and any specific information that helps more clearly identify what the problem involves. The overview should be concise (i.e., a maximum of two pages in length), but should provide enough detail for stage 2.
- Stage 2 – Deciding on hypotheses: in this second stage, the key stakeholders of the problem should review the overview, provide additional information to support it, and determine reasons for why they think the problem exists. The key stakeholders are people who have an interest in the problem, and/or are in positions of responsibility to potentially do something about it. It is the role of the analyst to collate the hypotheses and determine with the key stakeholders the hypotheses that should be tested. To produce a shortlist of hypotheses to test usually involves asking the key stakeholders to select the three main reasons (hypotheses) for why they think the problem exists. The testing of each hypothesis should also result in information that can inform a response. Practice suggests that three to five hypotheses is the preferred number to test, simply because there is unlikely to be analytical capacity to test any more in the timeframe available.
- Stage 3 – Analysis: the hypotheses frame the direction and content of the analysis. The primary objective is to come to some conclusions that provide evidence that does or does not support each hypothesis. The type of analysis to conduct is determined by the hypothesis that is tested. For example, if a hypothesis states that a recent increase in robberies is related to an increase in robberies against taxi drivers, the analysis will need to distinguish changes in the number of robberies by type (i.e., against taxi drivers,

against pedestrians, against people on buses) before and since the increase, if the increase in robberies has been wholly due to an increase in robberies against taxi drivers (or if a contribution to the increase has been from other types of robbery), and may even involve speaking to taxi companies and asking if they have witnessed increases in robbery victimisation against their drivers. The analysis may also examine those areas where robberies have increased the most to determine if in these areas it is robbery against taxi drivers that explains the increases. This process will also identify where there are intelligence gaps and data that may need to be collected in order to test a hypothesis e.g., a survey of taxi drivers to examine their experiences of robbery victimisation.

- Stage 4 – Conclusions and response recommendations: the hypothesis testing approach encourages a process that naturally leads to building evidence that can help explain why the problem exists, and in turn makes it easier to interpret these findings into conclusions. Key stakeholders (rather than just analysts) should be involved in interpreting the analysis. This is best conducted by holding a meeting to discuss the findings. It is at this stage that the key stakeholders should use the analysis to help decide how the problem can be addressed. Experience suggests that the better the problem is understood, the easier it is to determine the specific tactics and strategies that will counter the issues the analysis has identified.

Further details about the hypotheses testing crime analysis approach can be found here: <http://www.ucl.ac.uk/jdibrief/analysis/hypothesis-testing-crime-analysis>

3. Case studies

In this section case studies are provided that illustrate the application of the hypothesis testing approach and the technical analysis techniques that were used to develop a better understanding of certain crime issues in Mexico. More details on several of the technical analysis techniques that the case studies illustrate are provided in section 5. Four case studies are provided – cargo robberies on highways in Mexico, the illegal trafficking of weapons in North West Mexico, robbery of convenience stores in Irapuato, and poppy cultivation in Mexico. Several restrictions relating to data sensitivity mean that not all the analysis findings can be provided in each case study, but each study presents sufficient information that helps illustrate how each of these issues has been analysed in Mexico as part of the skills strengthening exercise in crime analysis.

Case study 1: Cargo robberies on highways in Mexico

In 2017, based on information recorded by the Mexico Federal Police, highway robberies increased by 13%, from 1,590 robberies in 2016 to 2,452 in 2017. On average, in 2017 there were 8 highway robberies per day in Mexico. The problem of highway robberies has continued to persist and is considered to be a strategic issue that needs to be addressed.

Rather than considering the problem of highway robberies as being uniformly or randomly distributed across Mexico, it was believed that these robberies were taking place in certain places and at certain times. It was also believed that certain types of cargo trucks were being targeted more than others due to the products they transport, and that an issue inhibiting successful police action on the problem of cargo robberies was the lack of effective coordination between federal and state authorities. These considerations led to three hypotheses being examined,

- ***Pattern of geographic and temporal concentration*** - a small number of highway segments account for a large proportion of highway robberies, with these robberies mainly taking place during specific hours of the day
- ***Lack of coordination between state and federal authorities*** - cargo theft is not a federal crime, but is instead a crime that is prosecuted by state prosecutor offices. The duty of policing the highways is performed by the Federal Police. These arrangements cause some difficulties when coordinating investigations, arrests and prosecutions for cargo robberies, resulting in fewer prosecutions than expected and the perception amongst offenders that it is a crime that has a low risk of punishment
- ***Increasing black market*** - the black market for the types of products being stolen from cargo trucks is given little attention in Mexico, making it easy to sell any products that are stolen, to a market that is happy to purchase stolen products due to their lower price and higher profit margin and no fear of stolen products being confiscated.

In this case study we only provide results relating to the first hypotheses.

A small number of highways segments account for a large proportion of highway robberies, with these robberies mainly taking place during specific hours of the day

In Mexico there are over 10,000 segments of highway. In 2016 and 2017 only 142 of these segments experienced one or more robberies. That is, of the 4042 robberies that took place between 2016 and 2017, all of these took place on less than 1.5% of highways across Mexico. This illustrates the geographic distribution of robberies is highly concentrated. Further analysis identified that just 6 highways in the central and western regions of the

country accounted for 44% of all robberies. The figure below also shows that robberies in central and western states of Mexico were also concentrated to certain times of the day. For example, in Guanajuato most robberies on highways took place during morning hours.

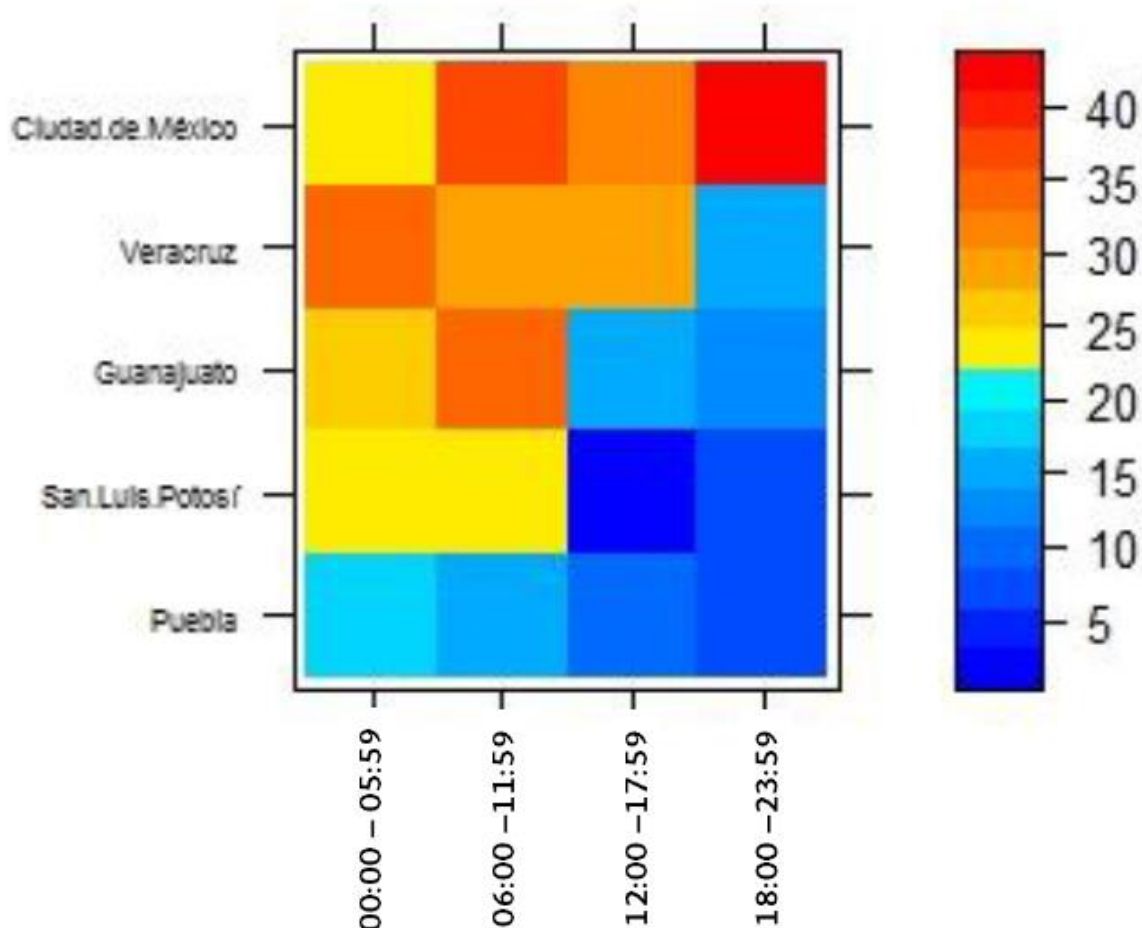


Figure 1. The distribution of robberies on highways by time of the day in the states of Mexico City, Veracruz, Guanajuato, San Luis Potosi and Puebla.

Analysis results of highway robberies in Guanajuato provide further illustration of the concentrated nature of highway robberies, alongside other information about the robberies that were committed in this state. Guanajuato has a population of 5.4 million and is ranked as the seventh most important economic area in Mexico. Guanajuato has 54 highways, 23 free federal roads, 19 free state roads, and 2 state highways connecting the major urban centres of León, Celaya, Irapuato, Salamanca, Guanajuato and Silao. 236 Federal Police officers are assigned to the state, with duties including highway patrol.

In Guanajuato, 3 specific highway segments accounted for over a half of all highway robberies: Querétaro to Celaya; Salamanca to Irapuato; and the highway in the León

Metropolitan Zone (see figure 2). Robberies along these three highway segments were all found to involve acts of violence against the driver, were situated at least 20 km from a highway patrol police station and mainly involved the theft of electronic goods, medical products and clothes. In two-thirds of offences black sedan or pickup vehicles were used in the commission of the robberies. Each robbery involved groups of offenders (typically 2-5 people) rather than a person operating on their own. This analysis helped to better identify the concentrated nature of highway robberies in Guanajuato, provided some indication of the types of cargo vehicles at most risk, and provided some useful details on certain characteristics of offending behavior.

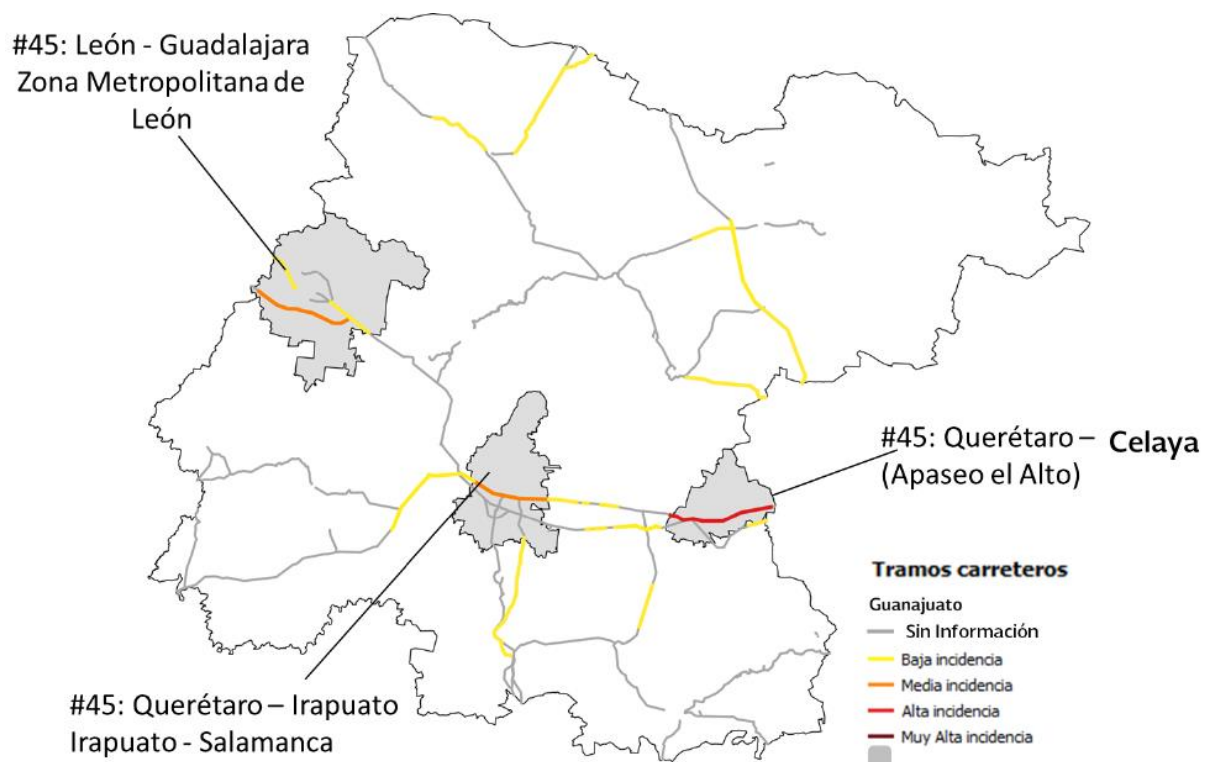


Figure 2. The geographic concentration of highway robberies in Guanajuato, highlighting three highway segments that accounted for over 50% of all cargo robberies.

The results of the analysis led to the following recommendations for the Federal Police, each of which were discussed with the highway patrol police chief:

- A redesign of highway police patrol schedules and activities, targeting deployment and surveillance in a more focused and strategic manner to highway segments that have experienced the highest levels of robberies
- Improvements in the recording of information about highway robberies to help further improve analysis, such as more exact details on where and when robberies take place,

the manner in which the offences take place (e.g., vehicles forced to pull over while on the highway or robbed while stationary), and the types of vehicles that are targeted.

- Training of highway patrol officers on hot route style of policing and additional training of analysts to assist in criminal investigations of serial offenders.

Case study 2: The illegal trafficking of weapons in North West Mexico

The objective of this analysis was to help identify and better understand the main land routes used for the illegal trafficking of weapons (including firearms, ammunitions and explosives) in the North West Region of Mexico (covering the states of Baja California (BC), Baja California Sur (BCS), Chihuahua (Ch), Sinaloa (Si) and Sonora (So)) between 2012 and 2017. Illegal weapons trafficking is defined as the acquisition, transport, storage and sale of weapons, weapons parts or ammunitions performed by a facilitator or a criminal organisation. Weapons trafficking is considered to be connected to other aspects of criminality, in particular helping to increase the strength of criminal organisations to commit other types of crimes (such as drug trafficking, homicides, extortions, kidnappings, and robberies), to protect these criminal groups and engage in combat with against Mexican authorities and other rival criminal organisations, as well as benefiting from the profits that come from selling arms. Information that was used in this analysis included data recorded by Mexican police and government authorities, and complemented from open sources.

Four main hypotheses were determined and were used to help structure the analysis:

- Certain areas of the region and specific routes within the region are used more than others by criminal organisations for illegal weapons trafficking
- The legal framework relating to gun control policies in Mexico is sufficient for addressing possession, use, and trafficking of weapons, but is not applied effectively enough by security and law enforcement authorities
- US gun control policies could influence the acquisition of firearms where the purpose is to transport these firearms illegally to Mexico.
- There is a high degree of permeability at the customs and crossing points on the border between the United States and Mexico which makes it easy for weapons to be transported into Mexico.

In this case study, more details are provided on the findings relating to routes and crossing points, but with summary points relating to the existing legal framework for weapons trafficking and gun control policies¹.

Data on seizures of firearms and ammunitions provides some useful information relating to the distribution of weapons trafficking in the North West Region of Mexico. Analysis of seizures data identifies that the states of Sonora and Sinaloa recorded the highest levels of seizures in the region, accounting for 62% of all arms seizures, 72% of ammunitions seizures and 81% of grenades seizures. Further analysis revealed that weapons trafficking was concentrated to a few municipalities. For example, the municipality of Culiacan in Sinaloa accounted for 1 in 6 of all firearms seizures, 11% of all ammunitions seizures and over a quarter of all grenade seizures. These findings provide an initial indication that weapons trafficking is more prevalent in some areas rather than in all areas of the region.

There are 48 official land crossing points between Mexico and the US, although four of these are either pedestrian only or northbound only routes. Of the total number of firearms, firearms parts and ammunitions seized at customs border crossing points (recorded by the Secretary of Finances/Secretaria de Hacienda), 45% were seized at five border crossing points in the region: Sonoyta (So) 16%; Ciudad Juarez (Ch) 10%; Tijuana (BC) 9%; Nogales (So) 7%; and Naco (So) 3%. Certain makes of vehicles were noted as the cars that were used most to transport arms and parts illegally - GMC, Chevrolet, Ford and Chrysler Dodge.

The analysis also identified five particular federal highways with the highest number of seizures

- **FH 1** connecting Tijuana, Ensenada, el Rosario and Guerrero Negro
- **FH 2** connecting Tijuana, Tecate, Mexicali and Sonoyta
- **FH 2** connecting Naco and Aguas Prietas
- **FH 15** connecting Sonora (Hermosillo, Guaymas, Ciudad Obregon and Navojoa) and Sinaloa (Los Mochis, Guamuchil, Culiacan and Mazatlan)
- **FH 45** connecting Juarez City and Ejido El Vergel

Of note was that the areas that experienced the highest levels of weapons, ammunitions and grenade seizures were those areas with the greatest presence of criminal organisations (Sinaloa Organization, Jalisco New Generation, Tijuana Organization and Juarez Organization).

¹ For further information refer to the Federal Law on Firearms and Explosives

Further analysis helped identify that even though the Mexican legal framework is clear in defining crimes and sanctions relating to firearms possession, use and trafficking, it would be important to reinforce this legal framework by revising the Code of Criminal Procedures and more clearly stating that it is a serious offence to possess or traffic firearms that are exclusively permitted for military purposes. Additionally, gun control policies in the US make it straightforward for weapons to be bought and transported over the border into Mexico for the purpose of illegal trafficking, with the indication being that certain land crossing points are used more than others.

The results of the analysis led to the following recommendations to senior police authorities in Mexico:

- Target checkpoints to those highways where weapons trafficking is most likely to occur (based on the results of the analysis)
- Target inspections to certain makes and models of vehicles that are thought to be the preferred vehicles of use by those involved in weapons trafficking
- Improve the quality and standardization of information that is recorded on arms, ammunitions and grenades trafficking and seizures, particularly in terms of the georeferencing of incidents, details on weapons storage sites and modus operandi of weapons trafficking.

Case study 3: Robbery of convenience stores in Irapuato

The city of Irapuato in the state of Guanajuato experiences a persistent issue with the robbery of convenience stores. This case study describes the use of two particular analysis techniques that were used to better understand the spatial and temporal distribution of the robbery of convenience stores in the city – the analysis of risky facilities and near repeat victimisation analysis (details on both techniques are provided in section 5).

Across Irapuato there are over 100 convenience stores. Based on a hypothesis that stated that a small number of stores accounted for a large proportion of robberies, the analysis revealed that only 7 stores accounted for over 50% of all robberies (see figure 3). Of these stores, two in particular (a Farmacia Guadalajara store and an Oxxo store) experienced 16 robberies in total in 2017.



Figure 3. Convenience stores in Irapuato that experienced the highest number of robberies in 2017.

A visual audit of the stores with the highest number of robberies identified each offered financial services (possibly indicating to offenders that large volumes of cash are likely to present in the store) and had obstacles placed in the shop windows (such as posters and boxes of products) that reduced the natural surveillance of the store.

A second hypotheses examined if a near repeat victimisation pattern was present – that is, that convenience stores close to where a recent robbery took place are at a higher risk of robbery soon after the initial robbery. This analysis revealed that stores within 200 metres of where a previous robbery had taken place experienced higher levels of robberies with 2 days in comparison to all other stores across the city. That is, stores close to stores that had been recently robbed were at higher risk of being robbed themselves soon after the initial incident.

As a result of these analysis findings recommendations included (and which were presented to police authorities in Irapuato):

- Visits to the stores with the highest levels of robbery by local police officers to discuss with the store manager practical ways that the risk of robbery could be reduced. This advice included improving the natural surveillance of the store (particularly from the roadside by removing obstructions from the windows), employing a security guard and minimising the amount of cash that is kept in the cashier and money transfer service tills
- Targeted police patrols and visits to stores in the areas (and over a period of three-four days) after a robbery in a nearby store.

Case study 4: Poppy cultivation and opium production in Mexico

Poppy cultivation and its influence on heroin production and wider criminality (particularly of organised crime groups) is a complex issue. Furthermore it is an issue for which very little data exists, making an analysis of the topic even more difficult. For this analysis a crime script analysis approach was used (more details on this technique are provided in section 5). The crime script analysis technique helps to understand and identify the stages, activities and actors involved in the commission of a crime or an illegal activity. Crime script analysis also helps practitioners to recognise the factors or conditions that influence, motivate or facilitate the offenders to commit the illegal activity. Using this analysis technique, it was possible to better understand the problem of poppy cultivation in Mexico, the different processes involved (e.g., comparing the production process for medical opiates to the production process for heroin), the regulation of acetic anhydride, and the social and economic context within which the cultivation of poppies and the extract of opium gum takes place.

A relevant point in the discussion of illicit poppy cultivation in Mexico is its geographic position with respect to the largest illicit drug user in the world - the United States. In 2013, 19% of the US population reported using an illicit drug. In addition to the use of illicit drugs such as heroin, the US has been confronted by an opioid consumption crisis that can be evidenced by the increase in the number of deaths by opium-related overdoses, specifically those related to heroin consumption (e.g., from 2010 to 2015 the number of people who have died from heroin overdose in the US has increased from 2000 deaths to 13,000 deaths) (see figure 4). During this same period (2010 – 2015) attempts have been made in Mexico to limit opium cultivation, with most practices focused towards destroying crops and attempting to seize opium gum. However, over this time the contribution from Mexico to poppy cultivation worldwide has increased from 8% to 10%.

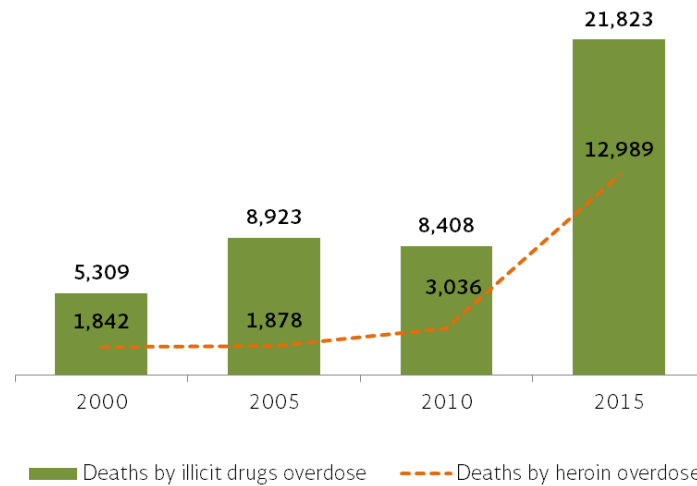


Figure 4. Deaths from illicit drug use and heroin overdoses in the United States (source: US National Institute on Drug Abuse)

The analysis that examined opium cultivation in Mexico using a crime script analysis approach provided the following new insights into poppy cultivation and opium production in Mexico.

Poppy cultivation for the production of opium gum in Mexico is concentrated in two particular zones. In the north, Durango, Chihuahua and Sinaloa is where almost two-thirds of poppy cultivation takes place, while in the south, Guerrero accounts for 30% of all cultivation. In municipal terms, 36 municipalities (7% of the 2,458 municipalities in Mexico) account for 90% of all poppy cultivation, with Guadalupe and Calvo (in Chihuahua), Tamazula (Durango), Badiraguato (Sinaloa), Chilpancingo de los Bravo, Acatepec and San Miguel Totolapan (each in Guerrero) being the municipalities that account for most poppy cultivation.

The analysis of poppy cultivation indicated that the places where the most poppy cultivation takes place are areas with a weak presence of public authorities and a lack of opportunities for integration into economic development. Poverty appears to be a key issue that tempts people or pressurises people into poppy cultivation. For example, in the municipality of Guerrero, the main poppy cultivation area in Mexico, 89% of its population was in a situation of poverty (2015) and 39% in extreme poverty (2015), in addition to approximately 29% of its population lacking in education. Also, the analysis identified a correlation between poppy cultivation and high levels of violence in areas where there appeared to be a lack of dominance of any criminal organisation.

The use of a crime script analysis approach also helped to better understand the process from the point of the acquisition of land for poppy cultivation to its harvesting (see figure 5), opium gum extraction and drug production (both in opiate form and as heroin). This analysis helped to identify that the lack of existing regulations relating to the use of acetic anhydride, an essential chemical ingredient for the production of heroin and an ingredient for the production of a wide variety of other products (such as plastic products), facilitates the transformation of opium gum into heroin.

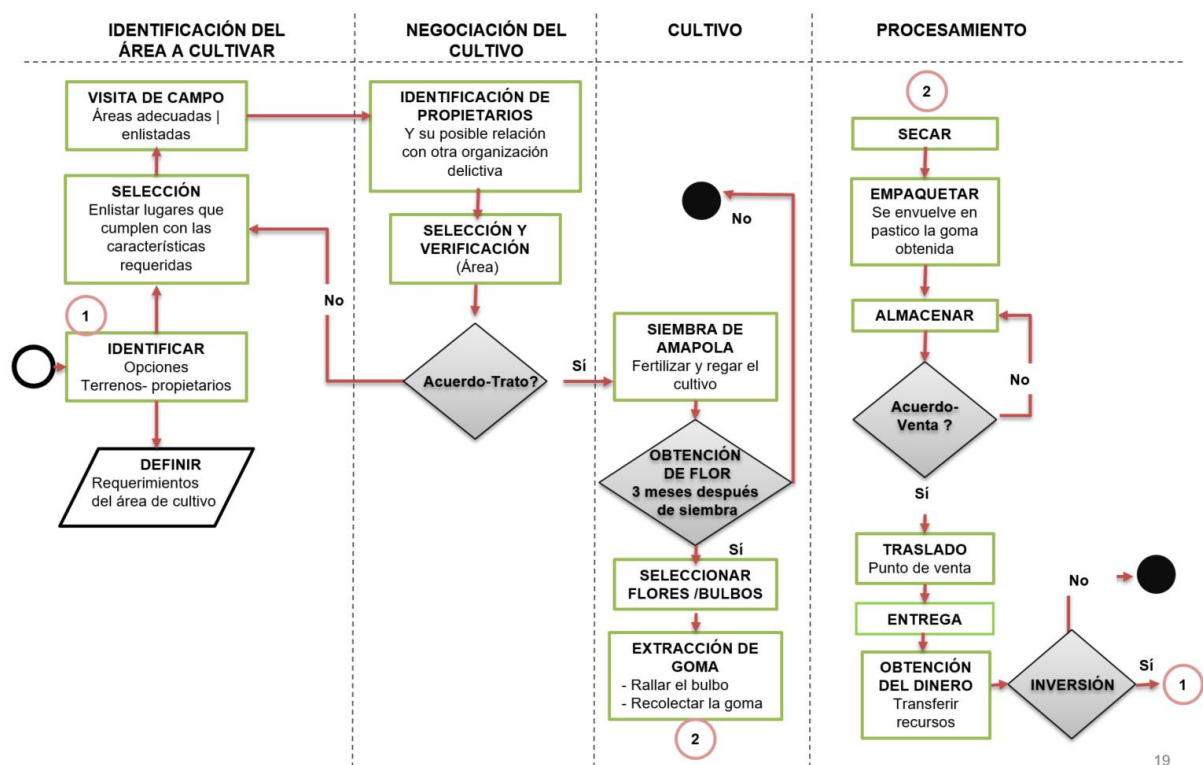


Figure 5. An extract from part of the crime script (this part relating to the cultivation of poppy, other parts related to opium gum processing, transportation and sale) that was produced to help better understand opium cultivation.

The analysis resulted in several public policy recommendations that are being considered at senior levels in Mexico:

- Place the discussion on palliative care and its impact on public safety as a topic in the National Security Cabinet
- Define a working group that develops a methodology to prioritize the objectives to be neutralized with the intention of reducing violence in poppy producing areas in Guerrero

- Improve the mechanisms for gathering and exchanging information on poppy cultivation and opium production
- Establish a working group that develops the agenda "Consolidation of monitoring mechanisms for precursors and chemical elements" to help limit access to chemical materials that are essential ingredients to heroin production.
- Improve the legal framework relating to poppy cultivation

4. From analysis to action

In addition to the recommendations and actions that have already begun to take place that relate to specific analysis projects (illustrated from the case studies), the results from the crime analysis skills development programme has had a wider impact. This includes using these examples to illustrate the types of findings that crime analysis can generate to police officers and other crime analysts. Three other initiatives have commenced following the experiences and lessons learned from the crime analysis skills development programme to help further develop crime analysis in Mexico.

- **Training of the Chief of Station in the Regional Security Division of the Federal Police:** in order to design and implement specific strategies for the highway robbery problem that Mexico is experiencing, the Regional Security Division decided to improve their skills in Smart Policing. This has involved the training of problem-oriented policing and evidence-based policing concepts to 27 federal police stations in the states of Jalisco, Queretaro, Guanajuato, Campeche and Aguascalientes. At the time of publication, 7% of the 319 stations and substations of the Regional Security Division of the Federal Police have been trained in policing techniques such as evidence-based and intelligence-led policing. By the end of the 2018, it is hoped that 40% of the stations and substations will have received this training. In addition, the Regional Division has a State Coordinator for each of the 32 states, with each State Coordinator having a seat in the Operative Coordination Group (GCO). This group consists of the state and federal public safety and justice system. The Federal Police expect to improve the coordination with other institutions through the elaboration of analysis products in the stations and substations, all of which would be shared via the GCOs to tackle the public safety problems each state is experiencing.

To help address the challenges of implementing this new paradigm of policing, such as cultural organizational resistance, the Regional Security Division has assigned a

Diplomat to the most qualified states. The training includes instruction on the SARA problem-solving method, the basics of designing indicators and evaluating police operations. An important part to this initiative was to develop a Strategic Territorial Plan, a new type of document that each federal police station must complete in order to monitor their operations. The evaluation of this document will be systematized through a control panel that will be consulted by the Chief of the Division. The Strategic Territorial Plans have highlighted, amongst other crime issues, the importance of tackling issues such as highway robberies, oil robberies, trafficking of narcotics at airports and road accidents. The 27 federal police stations involved in this activity should be operating with this new model by the end of 2018.

- **Hot spot policing contest for state police departments to reduce robberies:** local police departments represent almost 90% of the total police personnel in Mexico. The coordination between these different police departments is a key element to help tackle the public safety problems experienced in Mexico. In order to increase the quality of the coordination it is necessary to build successful cases where knowledge transfer is effective and as a result crime levels reduce. In this manner, a contest of hot spot policing has been initiated, inviting local police departments that possess good quality information to adopt the evidence based approach of hot spot policing to reduce robbery. The Comisionado Nacional de Seguridad (CNS) and University College London (UCL) will provide training in three of the four stages that comprise the hot spot policing interventions: diagnosis, design and evaluation. Once a local police department has demonstrated that it possesses georeferenced robbery data of a sufficient quality and analysts with basic skills for geospatial analysis, the CNS will work with the local police departments to develop crime profile products that offer an overview of the robbery issues in their areas. Then, UCL will deliver a training workshop where each local police department that has been selected for the programme will design a hot spot policing programme in a specific area of their city. In due course, and after the implementation of the hot spot policing programmes, an evaluation of the hot spot policing projects will be conducted by CNS and UCL. A report containing the results from the hot spot policing programmes will be published in 2019, and shared nationally and internationally to help enhance knowledge and the evidence-base on how to tackle robbery problems in Mexico and Latin America.
- **Training of social network analysis for CNS and the Federal Police:** the problem of organised crime in Mexico needs a new approach that moves from solely identifying and

targeting the heads of criminal groups to better understanding criminal networks of these groups. This new approach will include training in social network analysis, improvements in protocols for gathering, systematising and sharing information from field and criminal investigations, and modifications to the legal framework that allows for the presentation to court of the influence that individuals have within networks. In this way, the first step is the training. Those divisions of the Federal Police involved in investigating organised crime will be trained in the basics of social network analysis, and why this technique can help to improve our understanding of the evolution and interaction between individuals involved in organized crime groups. By the end of the training, the divisions should be capable of producing for themselves social network analysis products and use these to help improve how they investigate, collect data, arrest, disrupt and prevent organised criminality in Mexico.

5. Useful further resources – analysis techniques

In this section we provide further details about analysis techniques that were taught as part of the crime analysis skills development programme and which were used in the case studies.

Crime script analysis

Crime script analysis is a technique that helps to elicit greater clarity on the many entangled legal and illegal processes involved in offending behaviour, and the activities of interconnected participants (organisations and/or individuals) involved in illegal activity. As a result, crime script analysis can help build a picture of the decision-making of offenders by helping to uncover the influencing factors that may cause a particular behaviour or decision choice to occur. The technique can also be used to direct a data collection strategy, particularly in situations when the data about an issue may be sparse.

Crime script analysis can also help to improve how police and prosecutors respond to crime as it can help identify the factors that may be encouraging and creating opportunities for illegal activity. This includes helping to improve and direct the gathering of information to assist in offender identification and investigations, the gathering of evidence, identifying the best opportunities for detection, and better informing prevention strategies. The creation of a crime script can also help identify opportunities that enhance compliance towards legal behaviour.

Crime script analysis has been applied to a wide range of crime issues, including fraud (Lacoste and Tremblay, 2003), rape (Beauregard, Proulx, Rossmo, LeClerc and Allaire, 2007), stolen vehicle exportation (Morselli and Roy, 2008), cybercrime (Willison and Siponen, 2009), the illegal processing of waste (Tompson and Chainey, 2010), and human trafficking and child sexual exploitation (Brayley, Cockbain, and Laycock, 2011).

Crime script analysis involves attempting to describe the ways in which an offence unfolds and make explicit the series of decision-making points through which the offender passes in the process of crime commission. The construction of a description of a number of events

into a structured sequence can then together help to develop an understanding of the illegal activity. In this way, the technique is an attempt at answering questions relating to the skills that were required, the resources that were needed, the effort involved, and the people who are likely to be involved. This requires the analyst to consider or gather information on how the offender went about the commission of the illegal activity (e.g., how they accessed the crime scene, information about the crime opportunity, the financing required to carry out the crime, facilitators (tools, transport, weapons, communication), and technical expertise), the collection of data or knowledge specific to each activity and decision-making point, or formation of hypotheses that explain the behaviour that is most likely.

The construction of a crime script involves four key stages:

Step 1 – Breaking the script down into ‘Acts’ (the key stages involved in the illegal activity)

Step 2 – Writing the script - describing the scene, the cast (i.e., the individuals involved (known or not known, and who are required in order for the activity to take place), conditions and the activities

Step 3 – Interpreting the content of the script and visualising the results

Step 4 – Identifying how to tackle the problem

More details on the method for crime script construction are available in Tompson and Chainey (2010).

Crime script analysis offers structure to the way a complex crime problem can be considered. It offers a means of drawing out the necessary detail that is required to help understand the crime issue, and can also be used to help direct a data collection strategy. Its application has been successful in a number of different scenarios for helping to identify the best and most practical points for investigation and intervention. Crime script analysis does not require any particular software as it involves the analyst sketching out the decision-making involved in the criminal activity.

Social network analysis

Social network analysis (SNA) is the study of relationships between social entities. As a crime analysis technique, SNA helps identify the role of individuals in criminal networks (using statistical tools), helps to determine the relative importance of these individuals within the structure of the broader organised crime network, helps to target investigations and determine the disruptive potential of crime control policy.

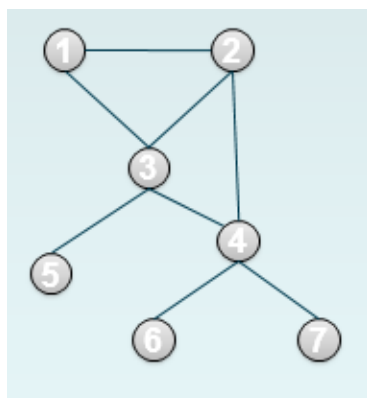
A person's position in a network determines, in part, the constraints and opportunities they will encounter. By determining the position of a person within the network can be valuable for helping to predict the person's performance, behaviour and their influence. What happens to a group is very much a function of the structure of the connections of the individuals among the group. SNA is a technique that can be used to better understand the group, the connections between individuals in a group, and who in the group to target.

The construction of a SNA requires the consideration of actors/nodes (the social entities whose relationships are to be studied, and which can include individuals, organisations, and even groups), relevant characteristics associated with these actors (e.g., age, family relationship, role in the group), and the links between these nodes (such as kinship, friendship, lines of communication, and business transfers). More details are provided in Borgatti, Everett and Johnson (2013) on the processes involved in constructing a social network.

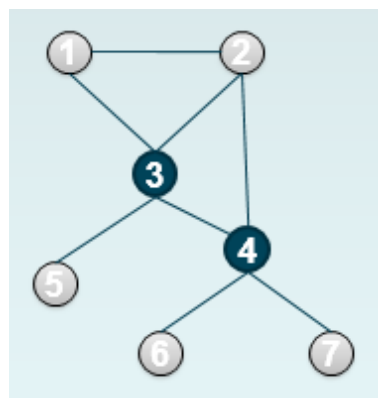
The construction of a social network provides the means to examine the links between people through common nodes, creates paths between nodes and their links whose

endpoints are connected through indirect means, and creates the connected web of the network. By doing so it provides the mechanism through which it becomes easier to identify how disparate parts of a system may affect other parts of that system.

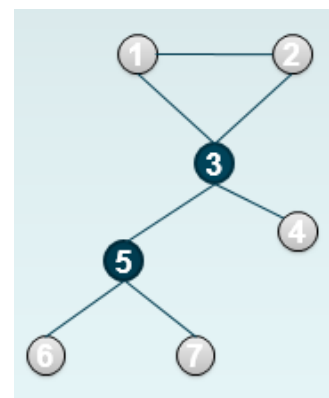
Rather than just considering SNA as the construction of a network chart showing the distribution of nodes and their links, the analysis of social networks can help determine who the key players are in a group. One particular set of metrics used in SNA relates to measuring the centrality of each individual within a network (see figure below). The eigenvector centrality measure helps identify the most central actors in a network by indicating how an individual is connected to other highly connected individuals. Those actors with high eigenvector centrality scores may be people who have only one or two connections, but they associate with key people with the most links. The betweenness centrality measure refers to how likely a node is to be in communication paths between other nodes, reflecting the extent to which a person mediates connections between people. People with high betweenness centrality scores in a network are those who have the potential to control the flow of commodities and/or information. In this way, eigenvector and betweenness centrality measures can be used to systematically study an organised crime group, determine which individuals are most important to that criminal group, and determine who to attempt to remove in order to have the most disruptive impact on the group. In a similar way, SNA can be used to help identify who to target and recruit as informants, how a network will change if certain people are removed from the group and predict any conflict that may occur within the group or between groups if certain people are removed or if their functions change.



(a) A social network involving seven actors, each connected due to their knowledge of each other in a group



(b) Nodes 3 and 4 have the highest eigenvector scores, indicating these are central actors to the group



(c) The network above reflects the communication paths between actors. Nodes 3 and 5 have the highest betweenness centrality scores, indicating these as important actors who mediate connections between people in the group

SNA has been applied to a number of scenarios for understanding criminal groups, including automobile theft rings (Morselli and Roy, 2008), terrorist groups (Medina and Hepner, 2008; Xu and Chen, 2003), drug markets (Bright et al., 2012; Malm and Bichler, 2011; Malm et al., 2011; Morselli and Petit, 2007) and money laundering (Malm and Bichler, 2013).

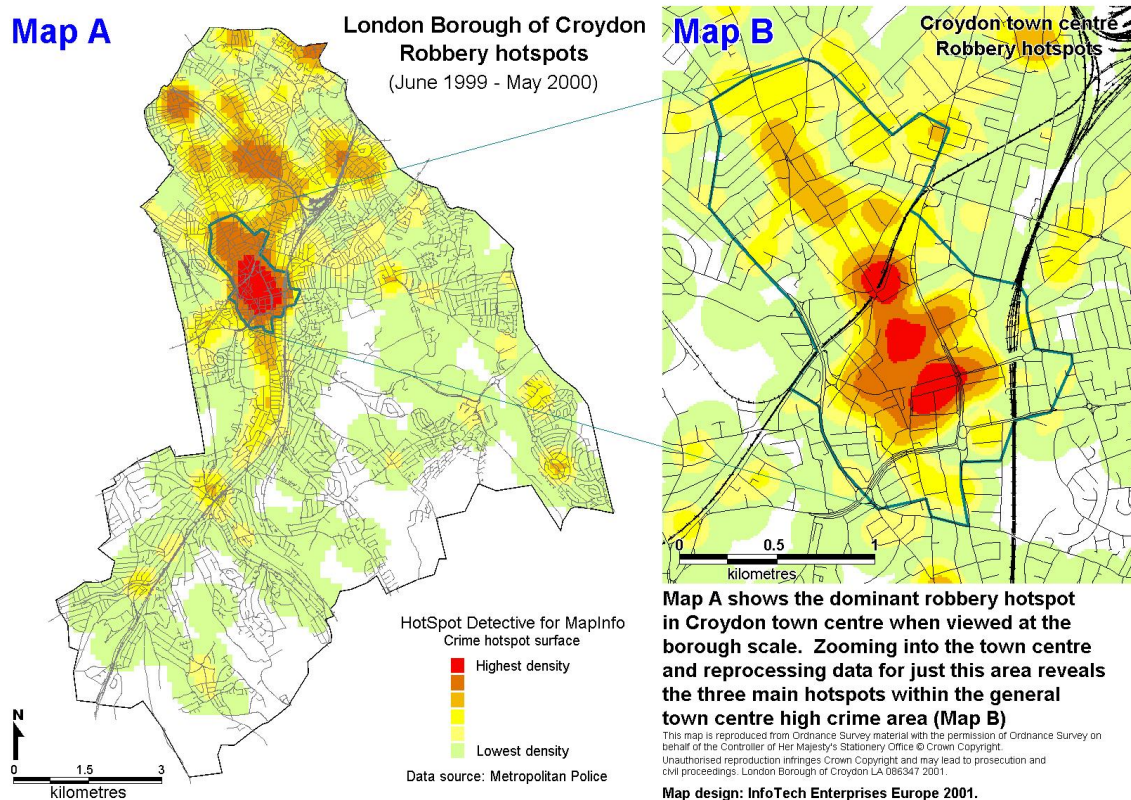
Social network analysis helps identify the role of individuals in criminal networks, and

measure the relative importance of each individual in a group. In doing so, SNA can help to determine how best to disrupt the network and where to target investigations. SNA does require specialist software (such as the commercial product i2), however options do include freeware software such as UCI Net and Gephi.

The analysis of crime concentration at places

Numerous studies have shown that crime concentrates in places. That is, a small number of places account for a large proportion of crime. Once these places are identified it can provide one of the best means for considering police resource targeting and prioritisation.

Many examples of analysis that examine the concentration of crime at places focus on the production of crime hotspot maps such as the example shown below. These types of maps are suitable for city and neighbourhood-level analysis and offer an effective way to visualise the concentration of crime at places. However, in many situations it is important to understand crime at more micro-levels, and also determine crime concentration statistics that can usefully accentuate the level to which crime concentrates.



A common approach used by many analysts to examine crime concentration at the micro-place level involves examining crime across street segments. This approach can help determine the specific places where police resources should be targeted and generate useful statistics that illustrate the extent to which crime concentrates. A common approach to use is to calculate the proportion of street segments that account for 25% and 50% of all crime. In the first instance this will require assigning each crime record to a street segment and from this determining the number of crimes that took place on each street segment. The result of this process can then be used to map those street segments where crime levels are highest, list these street segments in a table in rank order relating to the number of crimes per street segment, and generating crime concentration statistics from this table. An example of these hotspot statistics, a table listing the 'hottest' street segments and a map showing a hotspot with hot street segment is shown below.

<p>Hotspot statistics</p> <ul style="list-style-type: none"> • Number of streets in study area: 8042 • Number and proportion of streets responsible for 25% of robberies: 235 (2.9%) • Number and proportion of streets responsible for 50% of robberies: 639 (7.9%) 	<p>Streets where 25% of robberies concentrates (showing only the top ranked streets)</p> <table> <tr> <th>ID</th><th>Street segment name</th><th>N of robbery</th></tr> <tr> <td>1897</td><td>Av Artigas</td><td>9</td></tr> <tr> <td>3529</td><td>R Salta</td><td>9</td></tr> <tr> <td>2938</td><td>Av 9 de Julio</td><td>9</td></tr> <tr> <td>356</td><td>Av 25 de Mayo</td><td>9</td></tr> <tr> <td>7831</td><td>Av Santa Fe</td><td>8</td></tr> <tr> <td>6372</td><td>R Duarte</td><td>8</td></tr> <tr> <td>793</td><td>Av Rojas</td><td>8</td></tr> </table>	ID	Street segment name	N of robbery	1897	Av Artigas	9	3529	R Salta	9	2938	Av 9 de Julio	9	356	Av 25 de Mayo	9	7831	Av Santa Fe	8	6372	R Duarte	8	793	Av Rojas	8	<p>Map showing areas of significant robbery concentration and street segments that account for 25% of robbery</p>
ID	Street segment name	N of robbery																								
1897	Av Artigas	9																								
3529	R Salta	9																								
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356	Av 25 de Mayo	9																								
7831	Av Santa Fe	8																								
6372	R Duarte	8																								
793	Av Rojas	8																								

This type of crime concentration analysis is increasingly being used by police agencies to inform hot spot policing strategies. A guide containing more details of these techniques and which provides advice on hot spot policing is available for free from the IDB website. The analysis of crime concentration at places does require specialist geographical information system (GIS) technology such as ArcGIS or QGIS.

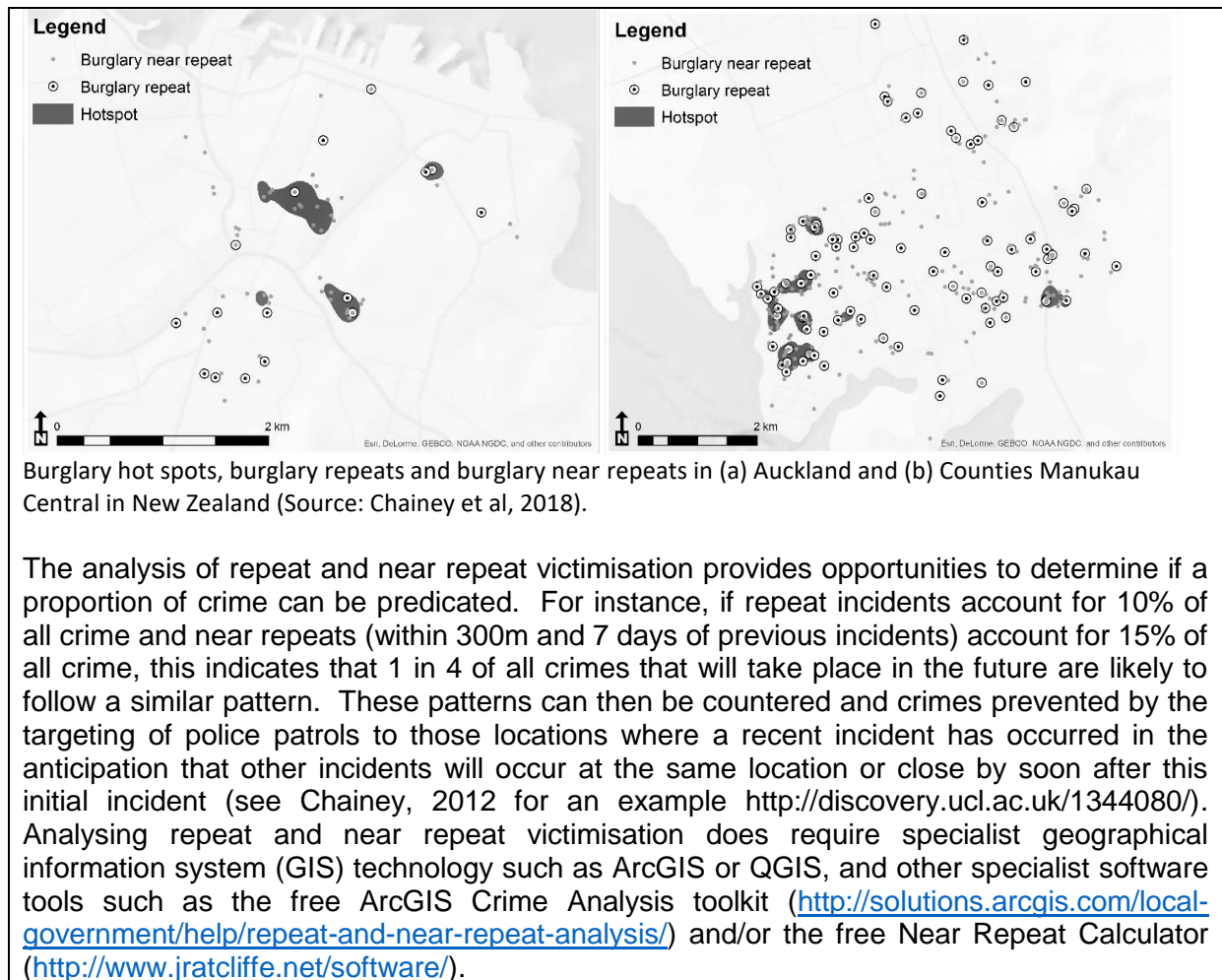
Repeat and near repeat victimisation analysis

Repeat victimisation is the pattern described for the heightened risk that results after an initial victimisation. Since primary studies in the 1990s, there has continued to be a growth in strong empirical evidence supporting repeat victimisation. The main findings from these studies have shown that:

- If you are a victim of crime you are at a heightened risk of being a victim of crime again. This is not to say you will definitely be a victim again, but that you are now at an elevated level of risk
- This heightened level of risk of repeat victimisation rapidly decays with time, dropping to the same level of risk as others within 1-2 months
- The highest period of risk of further victimisation is within a few days of the initial incident

These findings have subsequently resulted in many to consider that initial victimisation and the pattern of repeat victimisation is one of the best variables available for predicting crime.

Near repeat victimisation is the pattern described for incidents taking place within a short distance and short period of time of an 'originator' incident. For example, if a house is burgled, the neighbouring houses are also at a heightened risk of being burgled. The risk of victimisation is though considered to be lower than for the target that has been victimised, decays with distance from the victimised target, and decays over time (in a similar manner to how the risk of repeat victimisation decays over time). Theoretical reasons for explaining repeat and near repeat victimisation include the boost account, flag account and optimal foraging theory (see Chainey et al 2018 for more details).



The analysis of risky facilities

The pattern of repeat victimisation illustrates that crime is unevenly distributed across targets. Crime is also known to be unevenly distributed across facilities - facilities are places with specific public or private functions (such as bars, restaurants, supermarkets, parks, transport terminals, hospitals, schools, car parks). For instance, in a study of thefts from 26 bars of the same type in London, five bars accounted for 59% of all thefts; and in a study of violence incidents in the 28 parks across the district Chula Vista in California, three were responsible for over 50% of all incidents (Hilborn, 2009). The regularity of this pattern of risky facilities has led to it being termed the Iron Law of Troublesome Places (Wilcox and Eck, 2011)

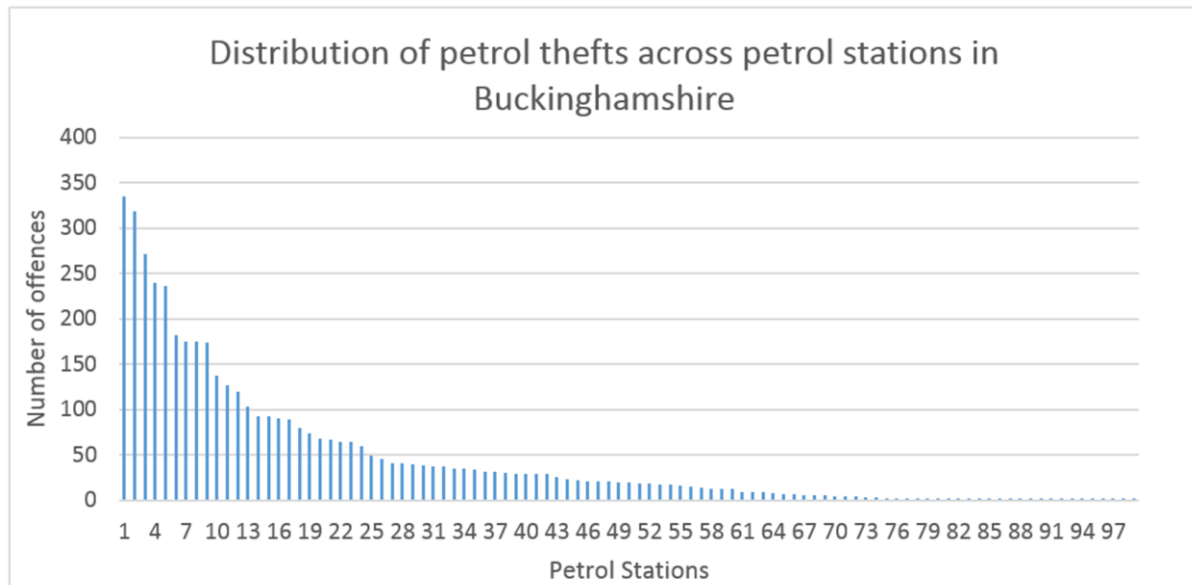
This risky facilities concentration pattern poses important implications for crime prevention as it can usefully target police patrol and preventive efforts. Additionally, while high risk facilities may be likely to appear within crime hot spots, there is an important analytic opportunity from comparing like-with-like facilities in order to discern the factors that make these particular facilities more at risk to crime than others.

The method for analysing risky facilities is straightforward:

- List all chosen facilities alongside a count of the number of relevant events (e.g., thefts, assaults, calls for service) at each facility
- Rank the facilities according to the number of events from highest to lowest. This may need further categorization, such as distinguishing between certain types of bars, or between private and public car parks

- Calculate the percentage of events that each facility contributes: $((\text{Number of crimes at facility of interest} / \text{Total number of crimes across all facilities}) \times 100)$
- Cumulate the percentages, starting with the riskiest facility
- Plot the number of crimes (y axis) by number of facilities (x axis) on a chart

The figure below shows an example for thefts of fuel from petrol stations in the county of Buckinghamshire, England. It shows that of the 100 petrol stations in this area, very few experienced incidents of theft, but a small number experienced a large proportion of all fuel thefts – 10 petrol stations accounted for 50% of all petrol thefts.



When analysing risky facilities it is also important to consider and take account of the distribution of opportunities specific to the crime being analysed. This requires the analysts to consider that rather than examining the volume of incidents, the crime levels should be analysed as crime rates by using a suitable denominator variable that represents the population at risk. For example, when analysing thefts from people in bars, denominators such as the size of the bar, or its capacity can be used. This helps to avoid only the largest facilities being considered and more appropriately considers risk.

The risky facilities concentration pattern is a straightforward analysis technique to apply and can provide useful direction for crime prevention resource targeting. To learn more about how to analyse risky facilities, consult this free guide – Understanding risky facilities http://www.popcenter.org/tools/risky_facilities/

The crime analysis skills development programme was delivered by Spencer Chainey from University College London, with financial assistance from the IDB and the UK Embassy in Mexico. Similar training programmes have been delivered in the UK, Denmark, Uruguay, New Zealand and Argentina. For further details about the training programme please contact Spencer Chainey s.chainey@ucl.ac.uk

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